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Nonlinear interactive effects of priming and temperature on soil organic matter decomposition

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Decomposition of soil organic matter (SOM) is sensitive to temperature and can cause positive feedbacks to climate. Priming, the stimulation of SOM mineralization induced by inputs of labile organic carbon (LOC), also affects SOM dynamics and stocks and consequently may trigger positive climate feedbacks[3]. Therefore, knowledge about how the interactions between priming and temperature affect SOM decomposition is central to understanding the terrestrial carbon cycle. Here we demonstrate that priming decreased with increasing temperature. Activation energy (E_a) for SOM decomposition nonlinearly responded to increasing temperature. SOM decomposition with higher LOC inputs showed higher E_a at low temperature, but lower E_a at higher temperature compared to low or no glucose inputs. Low LOC input reduced temperature sensitivity, while high LOC input strongly increased it. We conclude that priming caused by high LOC availability magnified the effect of increasing temperature on E_a at both the coolest and warmest temperatures while the effect of increasing temperature on E_a was reduced or absent at lower LOC availability. Therefore, greater LOC input via root exudates under future climate conditions (e.g. by elevated CO_2 or prolonged growing season) may accelerate SOM decomposition in a non-linear fashion and cause positive feedbacks to atmospheric CO_2.

Key words: Activation energy, priming effect, temperature sensitivity